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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/890,774	08/03/2001	Kenji Sato	1592-0134P	7871

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EXAMINER

QUARTERMAN, KEVIN J

ART UNIT PAPER NUMBER

2879

DATE MAILED: 10/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary

Application No.

09/890,774

Applicant(s)

SATO ET AL.

Examiner

Kevin Quarterman

Art Unit

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-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-4 and 6-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-4 and 6-42 is/are rejected.
- 7) ☒ Claim(s) 6 and 22 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 August 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>4</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the electrodes formed on front and rear of the substrate must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.
2. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim 6 recites, "both light emitting regions" in the third line of the claim. There is insufficient antecedent basis for this limitation in the claim.
4. Claim 22 is objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claim 22 has not been further treated on the merits.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
6. Claims 2-4 and 6-42 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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7. Independent claims 2, 8, 23, 29, 35, and 39 cite "an element converting the substrate of a first conduction type into the one of the second conduction type" in each of the claims. The addition of the term "type" extends the scope of the claim so as to render the claim indefinite (MPEP § 2173.05(b)). Claim 13 is indefinite for similar reasons.

8. Independent claim 2 also cites "...wherein dislocation density of the substrate is not more than 20,000/cm², or density of pits which are obtained by etching the substrate with sodium hydroxide aqueous solution at from 90°C to 130°C" in the last four lines of the claim. This phrase appears to be incomplete, and it is also incoherent.

9. The term "slow" in claim 13 is a relative term which renders the claim indefinite. The term "slow" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Therefore, the limitation of the element included in the diffusion source and gettering impurity in the substrate having a *slow* diffusion rate is rendered indefinite by the use of the term "slow" in the claim.

10. Due to their dependency upon independent claims 2, 8, 23, 29, 35, and 39, all other pending claims are deemed indefinite for the same reasons stated above.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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12. Claims 8-11, 13-21, 23-28, and 35-42 are rejected under 35 U.S.C. 102(b) as being anticipated by Marine (US 4295148).

13. Regarding independent claim 8 and claim 9, Figure 3b of Marine teaches a method of producing an electroluminescence device comprising the steps of providing a compound semiconductor crystal substrate (29) comprising a Group 12 element and a Group 16 element of the periodic table; disposing a diffusion source on a front surface of the substrate, the diffusion source including an element; forming a pn-junction by heat treating and thermally diffusing the diffusion source (col. 3, ln. 50-52); and forming electrodes (22, 30) on front and rear of the substrate, wherein the diffusion source disposed on the front surface of the substrate comprises a material including an element preventing forming of a defect compensating an impurity level.

14. Regarding claim 10, Marine discloses an element such the Gibbs' free energy of a compound which is formed by combining the diffusion source and impurity is smaller than Gibbs' free energy of a compound which is formed by combining a constitute element in the substrate and the impurity at a diffusion process temperature, or a material including the element (col. 3, ln. 50-52).

15. Regarding claim 11, Marine discloses the diffusion source being Al, Ga, In, or alloy thereof (col. 3, ln. 50-52).

16. Regarding claim 13, Marine discloses an element included in the diffusion source and gettering impurity in the substrate having a slow diffusion rate in the substrate compared with the element converting the substrate of the first converting the substrate of the first conduction type into one of the second conduction type.

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17. Regarding claim 14, Marine discloses an impurity being at least one of O, Li, Ag, Cu, and Au (col. 3, ln. 63).

18. Regarding claim 15, Marine discloses that the element included in the diffusion source, and gettering the impurity in the substrate is at least one of B, Si, and C (col. 4, ln. 6-7).

19. Regarding claims 16-17, Marine discloses a step of depositing the diffusion source over the front surface of the substrate by any one of a sputtering method, a resistance heating method, and an electron beam method (col. 3, ln. 50-52).

20. Regarding claims 18-20, Marine discloses a thickness of the diffusion source being 1,000 Å to 10,000 Å (col. 4, ln. 54).

21. Regarding claim 21, Marine discloses that the diffusion source is Al or In (col. 3, ln. 61-63).

22. Regarding independent claim 23, Figure 3b of Marine teaches a method for producing an electroluminescence device comprising the steps of providing a compound semiconductor crystal substrate (29) comprising a Group 12 element and a Group 16 element of the periodic table; disposing a diffusion source on a front surface of the substrate, the diffusion source including an element converting the substrate of a first conduction type into the one of a second conduction type; forming a pn-junction by heat treating and thermally diffusing the diffusion source; and forming electrode (22, 30) on front and rear of the substrate, wherein the diffusion source is disposed on a substrate plane having plane orientation from which a flat plane is obtained after etching.

23. Regarding claim 24, Marine discloses that the substrate is any one of ZnTe, ZnSe, and ZnO (Abstract).

24. Regarding claims 25-26, Figure 3b of Marine shows the substrate plane having the plane orientation from which a flat plane is able to be obtained after etching is (111) Zn plane, (001) plane, or (011) plane.

25. Regarding claims 27-28, Marine discloses that the front surface of the substrate is chemically etched (col. 2, ln. 13-15).

26. Regarding independent claim 35, Marine teaches like limitations of independent claim 23, as discussed earlier. Marine also discloses that the compound semiconductor crystal substrate has a carrier density of from $1 \times 10^{17} \text{cm}^{-3}$ to $5 \times 10^{18} \text{cm}^{-3}$ (col. 3, ln. 32-40).

27. Regarding claim 36, Marine discloses that the compound semiconductor crystal substrate is doped with another element (col. 3, ln. 32-40).

28. Regarding claim 37, Marine discloses that the substrate is any one of ZnTe, ZnSe, and ZnO (Abstract).

29. Regarding claim 38, Marine discloses that the diffusion source is Al, Ga, In, or alloy thereof (col. 3, ln. 51).

30. Regarding independent claim 39, Marine teaches like limitations of independent claim 23, as discussed earlier. Marine also discloses a depth of the diffusion being not less than $0.3 \mu\text{m}$ and not more than $2.0 \mu\text{m}$ from the front surface of the substrate (col. 5, ln. 60-62).

31. Regarding claim 41, Marine discloses that the substrate is any one of ZnTe, ZnSe, and ZnO (Abstract).

32. Regarding claim 42, Marine discloses that the diffusion source is Al, Ga, In, or alloy thereof (col. 3, ln. 51).

Claim Rejections - 35 USC § 103

33. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

34. Claims 2-4, 6-7, 12, and 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marine (US 4295148).

35. Regarding independent claim 2, Figure 3b of Marine shows an electroluminescence device comprising a p-type ZnTe substrate, a diffusion source (col. 3, ln. 50-52), and electrodes (22, 30) on front and rear of the substrate.

36. Marine teaches the claimed limitations of independent claim 2, as discussed above, but fails to exemplify a dislocation density of the substrate being not more than 20,000/cm². However, Marine discloses that the structure of the ZnTe substrate may be modified (col. 5-6).

37. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the ZnTe substrate of Marine with a dislocation density of not more than 20,000/cm², since where the general conditions of a

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claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

38. Regarding claim 3, Marine teaches the claimed limitations, as discussed earlier, but fails to exemplify an inclusion density on an interface of the pn-junction being not more than 50,000/cm².

39. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the device of Marine with an inclusion density on an interface of the pn-junction of not more than 50,000/cm², since where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

40. Regarding claim 4, Marine teaches the claimed limitations, as discussed earlier, but fails to exemplify the density of the inclusions having grain diameters of 0.3μm to 10μm on an interface of the pn-junction.

41. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the device of Marine with density of inclusion having grain diameters of 0.3μm to 10μm on an interface of the pn-junction, since where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

42. Regarding claim 6, apparatus must be distinguished from the prior art in terms of structure rather than function (MPEP § 2114 [R-1]).

43. Regarding claim 7, Marine discloses that the diffusion source is Al, Ga, In, or alloy including them (col. 3, ln. 51).

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44. Regarding claim 12, Marine teaches the claimed limitations, as discussed earlier, but fails to exemplify the diffusion source being Cl, Br, I, or alloy thereof. However, Marine discloses that elements other than aluminum may also be used (col. 3, ln. 61-64).

45. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the device of Marine with a diffusion source of Cl, Br, I, or alloy thereof, since it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use of diffusing into the substrate.

46. Regarding independent claim 29 and claims 30-32, Marine teaches like limitations of independent claim 23, as discussed earlier. Marine fails to exemplify a film thickness of the diffusion source being from 5nm to 50nm. However Marine discloses that the film thickness of the diffusion source may be varied (col. 5, ln. 14-17).

47. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the device of Marine with a film thickness of the diffusion source being 5nm to 50nm, since where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

48. Regarding claim 33, Marine discloses that the substrate is any one of ZnTe, ZnSe, and ZnO (Abstract).

49. Regarding claim 34, Marine discloses that the diffusion source is Al, Ga, In, or alloy thereof (col. 3, ln. 51).

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Conclusion

50. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fan (US 5548137) discloses a Group II-VI compound semiconductor light-emitting device. Ross (US 3576586) discloses a variable area injection luminescent device. Sakuma (US 6011271) discloses a semiconductor device with concave sections.

Contact Information

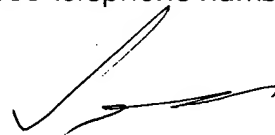
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quarterman whose telephone number is (703) 308-6546. The examiner can normally be reached on M-F (8-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel can be reached on (703) 305-4794. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Kevin Quarterman
Examiner
Art Unit 2879

kq *ka*



Nimesh Patel
Supervisory Patent Examiner
Art Unit 2879